The Acequias of San Antonio
San Antonio
Bexar County
Texas

HAER No. TX-1

HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

Historic American Engineering Record
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Department of the Interior
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HISTORIC AMERICAN ENGINEERING RECORD

THE ACEQUIAS OF SAN ANTONIO

HAER No. TX-1

Location: San Antonio, Bexar County, Texas

Dates of Construction: 1718-1777

Designer/Builder: Unknown

Present Use: Two acequias, the Espada and the San Juan, remain i operation as of 1974. The others are abandoned.

Significance: The Acequias of San Antonio were the Spanish coloni 1 water supply and irrigation systems used to support the region's earliest settlements. Five of the nin acequias were built to supply water to the Franciscan missions at San Antonio, while the remaining four were built for general use by the community. The irrigation and water supply systems were essential to the life of Spanish colonial San Antonio because they provided the only dependable supply of water for crops and domestic use in the arid environment.

The earliest acequia in San Antonio was the Alamo Madre which was begun shortly after the establishme t of the town in 1718. It was followed by four other acequias dug in the 1720s and 1730s to supply water to Missions San Jose, Concepcion, San Juan, and Espada. Four subsequent community acequias were dug in San Antonio: the San Pedro, Upper Labor, Alazan and Valley systems.

Two acequias, the Espada and the San Juan, remain i operation at the present time. The Espada acequia retain its original rubble diversion and original masonry aqueduct. Remains of other acequias are scattered over the city of San Antonio. One of the most interesting structures associated with the acequias is the restored grist mill at the San Jose Mission.

Historical Report Prepared by: T. Lindsay Baker, James D. Carson and Joseph . Minor, 1974

Prepared for Transmittal by: Jean P. Yearby and Donald C. Jackson, 1984

FOREWORD

This document was prepared at Texas Tech University by a team of engineers and historians who worked under the sponsorship of the Water Resources Center of Texas Tech University, the Historic American Engineering Record of the National Park Service, and the Committee on History and Heritage, the Texas Section, and the San Antonio Branch of the American Society of Civil Engineers. Dr. Joseph E. Minor, Lecturer in Civil Engineering, directed the efforts of the research team. He was assisted by Dr. Seymour V. Connor, Professor of History, Mr. T. Lindsay Baker, and Mr. James D. Carson, Graduate Research Assistants in History, Mr. Gary Rogers, Undergraduate Student in Architecture, and Mr. James G. Gibbs, Jr., Undergraduate Student in Civil Engineering.

The Texas Tech University Water Resources Center was established in 1965 to stimulate as well as to facilitate the development of broad-based interdisciplinary programs in water resources, education, and research. From the beginning, the research program of the Center has been directed toward the investigation and solution of problems peculiar to the Southwst and to other arid and semiarid lands.

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INTRODUCTION

The Acequias of San Antonio were important to the success of this, the largest Spanish mission center in the present United States, which b the middle eighteenth century comprised five Franciscan missions, a civ l settlement, a parish church, and a garrison of troops. These irrigation d tches guaranteed the success of good crops and harvests. Such agricultural p oduction was necessary for the support of both the settlement and the mis ions. The settlers and the troops needed garden produce for their diet and feed crops for their livestock simply to survive on the frontier. The issions had an additional need. If the Indian neophytes were not well fed, they were likely to run away to their former wilderness lives.

San Antonio was established in 1718 with a mission, a presid o (garrison), a small civil settlement, and the first acequia. A second mis ion was added in 1721, a settlement of Canary Islanders was founded in 1731, nd the following year three more missions were moved from East Texas to compl te the eighteenth-century settlement. A system of acequias for irr gation purposes was developed which was also used for domestic water supply. Becoming the capital of Texas in 1772, San Antonio emerged in the ninetee th century as the most important Spanish settlement between Santa Fe and Louis ana. It remained the major settlement during the Mexican period, the era of t e Republic of Texas, and the first decade of statehood, consistently ranki g among the first three cities in Texas. Two additional acequias were added a ter Anglo-American settlement. Without the acequia system, San ntonio might not have survived the early period to become the major city it is today.

The Founding of San Antonio

The first Spanish mission in Texas was Nuestro Padre de San rancisco de los Tejas, established in 1690 in East Texas. A second mission as founded nearby. The principal reason for their establishment had be n the fear of possible French intrusion in Texas. The missions, however, ere not permanent. Because of the extremely long line of communicat on with Mexico, a growing hostility among the Indians, and the absence of Fren hmen in the region, the missionaries left their posts in 1693. A quarte of a century passed before the Spaniards again attempted to found an outp st in Texas.

The second Spanish effort at beginning permanent settlement n Texas came in 1716. Again prompted by fears that the French were moving w stward into their territory, Spanish officials authorized an expedition to est blish the Spanish presence in strength in East Texas. Captain Domingo Ramon l d the party which established six missions and a military garrison. The locat on of the newly established mission field, six hundred miles from the neares Spanish settlements in Mexico, made transportation of supplies exces ively expensive. Spanish authorities in Mexico feared that the new settlers w uld turn to the recently established French settlements in nearby Louisiana or their needs.

Therefore, the viceregal government called a council in Mexico City, which decided to establish a halfway station between the Mexican settlements on the Rio Grande and the new East Texas outposts. The council chose Martin de Alarcon and Fray Antonio de San Buenaventura Olivares to establish a new stopping point, which became the city of San Antonio.[1]

The first recorded visit of Spaniards to the San Antonio region was in 1691, although Cabeza de Vaca may have passed there in 1534. Captain Domingo Teran de los Rios, the first Spanish governor of Texas, visited the area in 1691 on an expedition to strengthen the ill-fated first Spanish mission field in East Texas. Along the route the expedition came upon a gentle valley leading southward from a line of sharply defined hills. In his journal, Teran described the area:

> . . . . a fine country with broad plains--the most beautiful in New Spain. We camped near the banks of an arroyo, adorned by a great number of trees, . . . This I called San Antonio de Padua, hecause we had reached it on this day.[2]

Another early visitor to the San Antonio River Valley was Fray Isidro de Espinosa, who with Father Olivares in 1709 had visited the area around the head of the San Antonio River on his way to confer with Indians in East Texas. Espinosa described the large spring that fed the river in these terms:

> (It was) bordered hy many trees and with water enough to supply a town. . . . We named it San Pedro Spring. . . . The river, which is formed hy this spring, could easily supply not only a village hut a city, . . .[3]

The Alarcon expedition crossed the Rio Grande in April 1718, driving herds of livestock and carrying a large store of supplies, because Alarcon was ordered not only to establish the midway stop, but also to resupply the East Texas missions. Arriving later that month at San Antonio in advance of the main party, Father Olivares selected a site for a mission about May 1, 1718. On May 5, Alarcon established the nearby presidio of San Antonio de Bexar. The five or ten families that settled around the garrison began the civil settlement at what later hecame the most important Spanish post in Texas.[4]

Alamo Madre Acequia

The new mission was named San Antonio de Valero, the "de Valero" being added in honor of the Marquis de Valero, the Viceroy of New Spain. The site of the mission was on the west side of the San Antonio River ahout one or two miles south of the San Pedro springs and just east of San Pedro Creek.[5] Efforts at San Antonio were so disorganized, however, that when Alarcon returned on a second visit in January 1719, he was forced to remain one month to insure that the mission and the nearby civil settlement got a good start. The chronicler of the Alarcon expedition Fray Francisco Celiz, reported:

> On the 12th of the said month of January, . . . the governor gave orders to begin with all assiduity the construction of the canals for both the villa and the said mission of San Antonio de Balero (sic). This work was continued the remainder of the said month, in which they were built in good state and shape, so that this year a fine crop of corn, beans, and other grains . . . . is expected.[6]

The mission site on the west side of the river proved unsatisfactory, and in June or July 1719, Mission San Antonio de Valero was moved to the east bank, near its present location.[7] This move required the excavation of a new acequia later known as the Alamo Madre. The exact construction dates of the acequia are uncertain, although it can be assumed that work started as soon as possible after the move. Pedro de Rivera, who passed through San Antonio in 1727 on an inspection tour for the viceroy, noted that much work had been done on the irrigation ditch and that it was already two and one-half miles long.[8] In 1745 Fray Francisco Xavier Ortiz came to San Antonio to inspect the mission farms, he described as irrigated by a "large acequia."[9] It is assumed that the acequia was completed between Rivera's visit in 1727 and Ortiz's visit in 1745.

The main ditch of the Alamo Madre Acequia began near the spring-fed source of the San Antonio River and flowed southward toward the mission. Near the San Antonio de Valero Mission, it turned toward the west and then to the south, skirting its north and west walls. This appesrs to have been the extent of the acequia in its early years, the two and a half miles which Rivera had noted in 1727. Before Ortiz' visit in 1745, the acequia was extended on southward to a point where it reached the river. When Ortiz returned on a second visit in 1756, he noted that a secondary canal had been added to the original segment to loop through the mission compound. Besides the principal canals, smaller lateral ditches distributed the water to the fields. The total length of the extended Acequia Madre system, not including the laterals, was about six miles.[10]

San Antonio de Valero, like the later missions at San Antonio, had wells within the mission grounds. These wells provided the mission with drinking water and made it impossible for hostile Indians to cut off the colonists' supply of water. The purpose of the branch acequia through the compound was to supply the daily needs of water for bathing and washing clothes.

In 1793 Mission San Antonio de Valero was secularized. It remained nominally a Catholic parish for the local settlers, although it saw some use as a hospital, until 1822 when it was turned into s military post. At this time, that the name "Alamo" became associated with the mission because the military company garrisoning the fort were recruited at a post called El Alamo in Coahuila, Mexico.[11]

The later history of the Alamo Madre Acequia was one of gradually decreasing use. Irrigation wells began to reduce the need for the ditch by the 1870s,

while a water works company organized in 1877 removed the need for the acequia as a source of domestic water. Finally, the ditch became useful only as a sewer, and even this use was lost when the springs that fed the acequia reduced in flow after 1895 because of the lowering of the water table. In its later years the stone lining of the Acequia Madre was removed in places and used as building material.[12]

San Jose Acequia

About a year and a half after Mission San Antonio de Valero was founded, it became a haven for refugees from East Texas who were compelled by the fear of the French to leave their missions. The refugees built makeshift huts for themselves close to Mission San Antonio and waited for the arrival of the Marquis de Aguayo, who the viceroy appointed to reestablish the missions in eastern Texas.

One of the refugees, Fray Antonio Margil, discovered three Indian tribes in the San Antonio vicinity who yearned to have a mission of their own. These Indians were not friendly with the tribes at Mission de Valero. Margil wrote his good friend Aguayo, who issued a decree on January 22, 1720,, authorizing the establishment of a new mission. The Franciscan missionaries immediately began looking for a specific site for the enterprise. In the sesrch, they walked about three leagues along the meandering San Antonio River south of the San Antonio River south of San Antonio. There, on the east bank, they found a site on "an elevated, spacious and very level plain" which could be irrigated easily. On February 23, 1720, the presidio commander formally declared the founding of the new mission San Jose y San Miguel de Aguayo. The course of an irrigation ditch, two miles long, was traced and excavation was begun as soon as possible.

By the spring of 1724, work at San Jose Mission had progressed well. The irrigation ditch had been completed and a 160-bushel surplus of corn had been grown and sold to the presidio. Then, sometime between 1724 and 1727, the mission was moved to the west bsnk of the San Antonio River. The acequia on the east bank, or part of it, msy have been later used by Mission Concepcion after it was established in 1731.

San Jose's second acequia began at a dam on the San Antonio River and flowed in a southwesterly direction for about three and one-half miles to a point where it rejoined the river. There are only scant references to this second acequia in the early accounts of the mission. The ditch was probably operational by 1730.[13]

Fray Gaspar Jose de Solis commented in 1768 that inside the square at the San Jose Mission there was a well "from which there comes as large a flow of water as from a small river." This wster flowed through the square and joined the acequia outside the walls. Solis further noted that the irrigated farm of the mission extended more than two miles in length and produced abundant crops.[14]

Fran Juan Augustin de Morfi, perhaps more accurately than Solis, reported in 1778 that the mission farm covered a fenced area about two and one-half miles square. For the benefit of the farm, water was taken from the San Antonio River and distributed by means of a "beautiful irrigation ditch to all parts of the field" where corn, beans, lentils, cotton, melons, sugarcane, and sweet potatoes were raised.[15]

The subsequent history of the San Jose Acequia was much the same as that of the Alamo Madre Acequia--gradually increasing disuse and disrepair. The most troublesome problem with this acequia was the repeated washing out of its diversion dam at the river, which finally caused the abandonment of the canal in the latter half of the 19th century.[16]

Concepcion Acequia

When Pedro de Rivers visited Texas in 1727, his major purpose was to examine affairs in the province in order to recommend ways to reduce expenses wherever possible. Among his recommendations was the consolidation of the East Texas Missions. Rather than consolidate them, church authorities simply moved three of the missions to San Antonio in the spring of 1731.

During March and April of that year, fields at the three transferred missions were plowed and corn sown for a summer harvest. Construction of irrigation ditches began with Indian labor under the supervision of missionaries. This arrangement apparently was unsatisfactory becsuse one of the superiors, Fsther Benito Fernandez de Santa Ana, requested Antonio Rodriquez, a new settler from the Canary Islands and an experienced irrigator, to supervise the construction of the canal for Mission Concepcion. This mission was located on the east bank of the San Antonio River opposite the mouth of San Pedro Creek. Father Fernandez assigned a dozen Pajalache Indians to assist Rodriquez in the digging of the acequia. Because of their work on the ditch, the Concepcion Acequia came to be known by a second name, the Pajalache. Rodriquez determined grsdes and levels by the use of a plumb bob suspended from one point of an equilateral triangle. Following the line of least resistance, he adhered to the natural contour of the land, often going the long way around a ridge when excavating through it might have saved both time and effort.

Upon its becoming operational in 1731, the Concepcion Acequia took its water from behind a five-foot-high dam on the San Antonio River and flowed in an irregular southeasterly direction for a little over three miles before it reentered the river. The main ditch of the Concepcion Acequia was the longest of the scequias. Oral trsdition relates that the missionaries kept a boat on it for transportation snd maintenance. As noted previously, the upper portion of the ditch may have been dug earlier for the San Jose Mission.[17]

The canal was still in use in the 1820s, a quarter century after the initial secularization of the mission. At that time, the Spanish settlers were required to pay a tax for the water they drew from it to irrigate their

fields. By 1857 the Concepcion Acequia was virtually inactive and its diversion dam was considered a problem in flood control. A Texas Supreme Court decision in 1868 ordered the dam cleared from the river.[18]

San Juan Acequia

Mission San Jose de los Nazonis was another of the missions moved from East Texas to San Antonio. It was reestablished on the San Antonio River on March 15, 1731, and renamed San Juan Capistrano. The site of the mission was on the east side of the river about four miles downstream from Mission Concepcion. By May 4, 1731, crude huts were built and Indian neophytes gathered at the mission. It is likely that before the end of the year, the acequia was at least partially operational. This acequia began at the dam on the river opposite San Jose and flowed approximately four miles until it entered an arroyo that drained back into the river. It watered approximately 500 acres for almost 200 years. Despite the secularization of San Juan Mission in the late 18th century, the San Juan Acequia continued to be operated by private individuals into the 1920s. A portion of the acequia has been renovated and operates today, providing irrigation water to fields south of San Antonio.[19]

Espada Acequia

The third mission to be moved from East Texas to San Antonio was San Francisco de los Neches, which in its new site was renamed San Francisco de la Espada. This mission was located on the west side of the San Antonio River opposite Mission San Juan. Work began on an acequia at Espada soon after the transfer of the mission to San Antonio.

The course of the Espada Acequia required that its water be transported across Piedras Creek by an aqueduct. It is uncertain, however, when the present aqueduct was built because the original acequia could have been constructed without its use. Less durable aqueducts consisting of hollowed-out logs called canoas were used in the early canal systems to span gullies and other canals. Most local historians choose the years between 1740 and Fray Ortiz' visit in 1745 as the probable period for the construction of the present aqueduct. Whatever its date of construction, it still stands about a mile north of Espada Mission, where it continues to carry irrigation water. Two arches of cut stone from the Concepcion quarry support the structure. Fray Alto Sebastion Hoermann, who served at nearby Mission San Jose in the 1860s, related at that time that the section between the arches had become detached from the foundation, but because of its strength the aqueduct had remained standing. Local folklore relates that the excellence of the structure is due to the addition of the whites of thousands of eggs and a large quantity of goal milk to its mortar. In reality over the years the masonry has become cemented into a solid mass by the deposition of lime from the irrigation water.[20]

Use of the Espada Acequia was discontinued in the 1880s, but in 1895 the Espada Dutch Company was organized to reactivate the system. The company

cleaned, widened, and deepened t e ditch and repaired its original diversion dam. It continues to operate th acequia at the present time. The aqueduct and a section of the canal are p eserved within Acequia Park. The portion of the river containing the Espada am was bypassed by a new flood control channel in the 1960s, but measur s were taken to preserve the water level behind the dam and in the acequi .[21]

San Pedro Acequia

Despite the existence of two mis ions and a presidio in 1722, San Antonio lacked sufficient population to rosper. Acting upon a recommendation of the Marquis de Aguayo, Spanish autho ities decided to resettle families from the Canary Islands at San Antonio. elay followed delay until 1729, when actions were taken to implement the plar Spanish administrators then had second thoughts about the project, but ot until twenty-five families had begun the trip. Enroute, some families dr pped off to settle elsewhere so that only fifteen families (56 people) rea hed San Antonio in March 1731. The settlers were granted free land and permi ted to establish their own town, Villa de San Fernando de Bexar.[22]

The dates of construction by the colonists of a ditch for their own use, later known as the San Pedro Acequia, re uncertain, but some sort of canal was obviously in operation by 1735. On April 14 of that year, Juan Leal, chief regidor of Villa San Fernando, c dered the irrigation ditches of the villa fields to be repaired. On May 2 , Leal complained that the order had not been executed and ordered the settle s to place in operation the mother canal which received its main flow of the wa er from the San Pedro Creek. It seems certain that at least part of th e main canal was under construction at that time and it was probably finishe l the next year.[23]

Antonio Rodriquez, the Canary Is lander who had supervised the construction at the Concepcion Acequia, was cal ed upon to direct that of the San Pedro Acequia. As planned by Rodrigue , the ditch took its water from San Pedro Creek near San Pedro Springs an along the watershed between the San Antonio River and San Pedro Creek. It w s 6 feet wide and 2 feet deep, and watered about 400 acres of land on both sides of its 4-mile length. Its watershed location left the San Pedro Ace ia free from the cross-drainage problems which continually troubled the c her canals. Although it was also designed to serve the parish church as well s the settlers, the canal was the first in San Antonio primarily for the c vilian settlers.

The San Pedro Acequia saw activ use for over a century. In the latter part of its history, it furnished th business district of San Antonio with drinking water. The post-Civil War boom of San Antonio saw most of the land irrigated by the acequia occupi l by housing and by 1906 the water flow in the ditch ceased.[24]

Upper Labor Acequia

In 1772, tbe Spanish uthorities in Mexico decided to abandon East Texas. The Louisiana Cession of 763 had extended the Spanish boundary to the Mississippi, removing the need for the East Texas settlements as border outposts. In 1773, t e East Texas colonists were transferred to San Antonio. The government gave t em free land and the right to dig an irrigation ditch. Although most of the eople later returned to East Texas, some of them remained in San Anton o, where they dug the last acequia of the Spanish period.

The Upper Labor Acequ a was probably begun in early 1777 and was finished by March of 1778. The d tch started behind a loose rock dam at the San Pedro Springs. It flowed o the west side of the river in a general south-southwesterly d rection to a point where it emptied into the San Pedro Acequia. In 1877, th city of San Antonio replaced the old dam with one of masonry. The canal w tered 600 acres of land and was maintained until the end of the nineteenth cen ury.[25]

Alazan Ditch

The last major acequi to be built in San Antonio was the Alazan Ditch. Following plans prepa ed by Francis Giraud, construction started in 1872. By June 6, 1875, the dit h was opened to partial use, but its completion was delayed until sometim in the latter part of 1876. The Alazan Ditch took its water from the Upper abor Acequia near its head. It proceeded north and then west, skirting the he dwaters of San Pedro Creek, and then went southward to where it ended at an ntersection with South Laredo Street where it dumped wastewater into Alaza Creek. The area watered by the Alazan Ditch was wst of San Pedro Springs and appears to have consisted of a number of small land holdings. The Alazan was abandoned in 1896 because residences weere built on the land it formerly rrigated. Since that time, its remains have been blotted out by homes nd businesses constructed along its course.[26]

Valley Ditch

The Valley Ditch, dug about 1872, was a major branch of the Alamo Madre Acequia. It may have resulted from a recommendation to provide water to the Concepcion Acequia (a d thereby eliminate the obstruction in the river presented by the Conc pcion Dam) via the land between the city and the Power House Hills. This di ch began at the source of the Alamo Madre near present-day Grand Ave ue, proceeded down Walnut Street to a course bearing left of Goliad Road, nd continued on to a point beyond the southeastern limits of the city. s a result of engineering errors in its grade, the Valley Ditch as abanc ned almost immediately after its construction.[27]

Geological and Topographical Background

The acequia system of San Antonio lies on the edge of the Balcones Escarpment, a fault zone which divides the Gulf Coastal Plain region from the Edwards Plateau region of Texas. In the area near the escarpment, the Gulf Coastal Plain is a rolling or moderately hilly area with both wooded and prairie vegetation.

The surface waters in the San Antonio area originally came almost exclusively from springs. These springs received their water from an aquifier in the Edwards Plateau which outcropped at the fault zone. In the 18th and 19th centuries, the springs provided almost the entire flow in the San Antonio River and San Pedro Creek, the sources of water for the acequias. The few wells dug by the early Spanish colonists had only a negligible effect on the water table. As the population of San Antonio grew after the successful Texas Revolution of 1835-36, however, Americans in the city drilled numerous free-flowing artesan wells to supply water for their agricultural, municipal, and industrial needs. Due to the withdrawal of vast amounts of this underground water for these purposes, the level of the artesian aquifier gradually lowered. As this lowering occurred, the flow of the natural springs reduced and in some cases ceased entirely. At the same time, urban growth increased runoff from city streets into the streams, which supplemented the reduced spring flow. The runoff now provides the bulk of the water which flows through the two remaining operating acequias.

In the mid-twentieth century, a flood control program was undertaken to regulate the increased urban runoff in San Antonio. The project consisted primarily of straightening and widening the San Antonio River channel. As part of the work, some sections of the channel received concrete lining. Due to these and other changes during the project, the flow of water in the channel and in some of the acequias was altered.

An attempt was made during the construction work to preserve the original hydraulic conditions of the Espada Acequia. Engineers took care to divert a quantity of water to the Espada diversion dam from the new river channel. Unfortunately, similar care was not taken with the San Juan Acequia. During the construction, the river channel was changed in such a way that the flow to the San Juan was stopped. This situation remained until the owners of water rights on the acequia took legal action. As the result of a successful court suit by the water rights owners, a new dam was constructed to return normal flow to the San Juan Acequia.[28]

Technical Background

The Acequias of San Antonio were in simplest terms a series of ditches which transported water from the river to the fields. The individual systems generally consisted of some sort of diversion works and actual canals which carried the water to the fields and in most cases returned the unused portions to the river.

The technological significance of the Acequias of San Antonio lies in the fact that they are among the earliest examples of European engineered water supply and irrigation systems in what is now the United States. They contain the only operating Spanish aqueduct and diversion dam in the country. Irrigation procedures on the Acequias are notable in that they represent the preservation of Spanish irrigation techniques and customs in America for over two and a half centuries.[29]

In most cases, the individual acequias had their own diversion dams to provide a sufficient entrance head for flow through the system. The more substantial of these dams were built of mortar and stone, although more often they were of loose rock and brush. The one remaining original dam, the one diverting water into the Espada Acequia, was built of flag stones laid upon each other on the edge of a natural stone ledge across the bed of the San Antonio River.[30]

The principal behind the operation of the canals was to take water from the river and then carry it at a slight grade through the countryside to the fields. By adhering to the general elevation contours as it passed down the river valley, the acequia itself would move farther and farther away from the river, thus leaving an increasing amount of land between itself and its source. As the intervening land lay at a lower level than the acequia, the irrigation water could flow down lateral ditches in the direction of the river and in this way irrigate the fields. Excess water either returned to the river directly from the fields or by way of an extension of the acequia dug specifically for that purpose.[31]

No records describing the actual staking out of any of the Acequias are known to exist. Oral tradition holds that for leveling and determining the grades of the canals, the builders used a wooden frame in the shape of a large equilateral triangle. This frame supported a plumb line from an apex and the plumb line pointed to a scale on the opposite side of the triangle. By placing this side of the triangle in the bottom of the ditch, the grade could be checked by noting where the plumb line crossed the scale. The grade of the Espada Acequia, which was somewhat modified by Americans in the late 19th century, is today 23 inches per mile. The builders of the acequias closely followed the natural contours of the ground, many times going the long way around a hill or ridge where today a modern ditch would cut across.[32]

One of the features of the Acequias of San Antonio noted by many of their observers is the surprisingly steep banks that lie on either side of the ditches. These levees were built higher and higher each spring as the farmers cleaned the acequias. As they worked, the farmers threw the accumulated silt

and vegetation out upon the banks, thus building them up gradually from year to year. In places where acequias have been abandoned, these parallel mounds of earth frequently continue to mark their former locations.[33]

Nine acequia systems were built in San Antonio between 1718 and 1876. Of these nine systems two, the Espada and the San Juan, continue to operate at the present time. Only limited remains exist of the seven discontinued acequias, as they are being increasingly obliterated by urban growth. It is significant that the last two functioning acequias are the two farthest from the city center.

Alamo Madre Acequia

The Alamo Madre, the oldest of the San Antonio Acequias, derived its water from the east side of the San Antonio River near its headsprings. Following the natural contours of the land, the acequia flowed in a southerly direction toward what later became the center of the town of San Antonio. As originally constructed, it passed by the Mission San Antonio de Valero, the mission for which it had been constructed, and emptied into the nearby river. After a few years, the mission Indians extended the Alamo Madre Acequia two miles to irrigate more lands. In this final form, the main ditch of the Alama Madre Acequia stretched six miles and provided irrigation water for about 900 acres. The Alamo Madre operated until the beginning of the 20th century, after which time its fields were consumed by urban housing and its channel was converted into a storm sewer.

Only a few sections of the Alamo Madre Acequia remain, but these portions are among the best preserved from Spanish times in all San Antonio. Two remarkable sections were excavated in 1966 and 1969. The first of these, a 94.3 foot portion, is located within the Witte Museum complex at Hemisfair Plsza, adjacent to downtown San Antonio. The ditch at this location is stone lined and 6.3 feet wide by 5.2 feet deep. Its original lining was soft, quarried limestone blocks set in dry, sand mortar. The originsl earthen bottom of the canal has been covered with concrete.

The second excavated section of the Alamo Madre Acequia is located just east of downtown San Antonio at a site known as the Zilker property. This site is one the irregularly shaped block bounded by Bowie, Nacagdoches, Elm, snd Starr Streets. The excavated portion of the acequis is 62.8 feet long and stone lined in a manner similar to the other excavated section. It is somewhat narrower, averaging 4.6 feet in width. A concrete-capped storm sewer located in the bottom of this section has prevented excavation to the full depth of the ditch. The striking feature of the Zilker property section of Alamo Madre Acequia is the original Spanish stonework intact along its sides. Many of the stones sre irregular in length and finely dressed. A sluice gste on the west side of the acequia offers insight into the construction of such auxiliary structures on the canals. Along the west side, at 5-foot intervals, are notches in the stone lining in which wooden fence posts once stood, probably to support fence rails that prevented animals from falling into the ditch.

A third section of the Alamo Madre Acequia lies behind the chapel at Mission San Antonio de Valero. It was originally the branch of the Alamo Madre Acequia that flowed through the mission compound. This section of the acequia unfortunately was lined with concrete earlier in this century and converted into a elongated fish pond, thus effectively obliterating the earlier traces of the ditch.[34]

San Jose Acequia

The San Jose Acequia was probably the first acequia constructed after the Alamo Madre Acequia. Begun about 1730 to supply water to the San Jose Mission fields on the west sidde of the San Antonio River, the main ditch secured its water from the river a short distance below its junction with San Pedro Creek. A loose rock dam diverted the water into the head of the canal. From that point, the San Jose Acequia followed the contours of the land to the mission. After flowing along the north side of the mission compound, the acequia passed on an additional mile before returning to the river. Its main ditch, meandering 5 miles from the diversion point to its outlet on the river, irrigated approximately 600 acres of mission lands. A troublesome problem with the San Jose Acequia was the repeated washing out of its diversion dam. This finally caused the abandonment of the ditch about 1860. Today, the only readily visible section of the San Jose Acequia is the weathered portion that runs north of and parallel to the walls of the San Jose Mission.

Probably the most striking feature of the San Jose Acequia is the Spanish mill beside it at the north side of the mission compound. The mill, built about 1790, derived its motive power from a small stream of acequia water which drove its horizontal waterwheel. The rotating impulse waterwheel drove a vertical drive shaft to which the millstones were directly attached. The San Jose mill was rediscovered during excavations in 1934 and reconstructed over its original foundations.[35]

Concepcion Acequia

Built about the same time or just after the San Jose Acequia, the Concepcion Acequia provided water to the Concepcion mission lands east of the river. It took its water from behind a 5-foot-high dam across the San Antonio River on its south loop in the heart of the city. This diversion dam was on a line with South Presa Street, close to the site of the present San Antonio Public Library. After leaving the river, the canal turned almost immediately into what is now South St. Mary's Street and followed its general line to the mission. The acequia continued beyond the mission in a southeasterly direction for 3,500 feet before turning west to rejoin the river below the dam of the San Jose Acequia. The Concepcion system watered its fields through a large number of lateral ditches that stretched from the main canal toward the river. Reputed to have been the largest of the Acequias, oral tradition reported that the mission fathers kept a boat on the Concepcion for use in both transportation and maintenance. Used for over a century, the Concepcion Acequia became almost inactive by 1857. Its diversion dam, located in the center of the growing San Antonio business district, was considered a cause of

flood damage bec use it backed up water in the river during heavy rains. After citizens o San Antonio complained about the unused dam for over a decade, the city administration finally removed it in 1869.[36]

San Juan Acequia

Begun in 1731, t e San Juan Acequia is one of the two still-functioning acequias at San ntonio. The ditch takes its water from the east side of the San Antonio Rive at a point opposite Mission San Jose. As the acequias operates today, new concrete diversion dam supplies the irrigation water which in the can l follows the contour of the land to a point approximately one-fifth of a m le east of Mission San Juan. Here, the acequia separates into the "lower" and "upper" branches. The lower branch flows west to the old San Juan Mission lands, where farmers use its water for irrigation. It then flows south an a dition one and a quarter miles, roughly paralleling the San Antonio River be fore returning its unused water to it. The upper branch continues south from the separation point slightly over one and a half miles before it also r turns to the river. At the present time, the upper branch flows through it entire length only during times of high water in the river.

During the ninet enth century, the San Juan system watered 50 acres of agricultural lan l. In the mid-20th century, the acequia fell into disuse, but in the late 1960 s, after a court suit for the restoration of its natural flow of water, the sy stem resumed operation. It continues in vigorous use at the present time.[37]

Espada Acequia

Without questior , the best preserved of the Acequias of San Antonio is the Espada Acequia. Operating for over two centuries, the system contains the only functioning Spanish colonial dam and aqueduct in the United States.

The Espada Dam c iverts water into the Espada Acequia at a point on the west side of the San ntonio River in the Mission Burial Park, about six miles downstream from the San Antonio business district. The dam has an overall length of appro imately 160 feet with a height varying from 6.6 to 8.2 feet. The crest of the dam averages 2 feet in width, with bottom width varying from 20 to 40 feet. It is composed of layers of flag stones placed upon each other on a natural le ge across the river. The permanence of the Espada Dam can probably be asc ibed to the flag stones becoming gradually cemented together through the dep sition of lime salts from the river water.

As it was origi ally constructed, the Espada Acequia flowed south from its diversion point crossed Palo Blanco Creek and Piedras Creek, and passed the Espada Mission n the west by some distance. The ditch continued southward to a point where i joined La Minita Creek, which in turn, flowed into the San Antonio River.

The most striking structure on the Espada system is clesrly the Espada Aqueduct. Built sometime between 1731 and 1745, the sturdy masonry aqueduct continues to carry Espada Aceqauia water across Piedras Creek, sbout a mile north of Espada Mission. Two cut stone arches, one 12 feet and the other 16.5 feet in diameter width support the structure. Over the arches snd the abutments at each end, the aqueduct stretches a total of 195 feet. It stands 15.5 feet high at the point where it crosses the creek. Like the Espada Dam, the aqueduct hss become cemented together by the lime salts in the water. The mass of the aqueduct was so solid that when its lower section between the arches had become detached from the foundation by erosion, the entire structure remained in position. The aqueduct has withstood the forces of severe floods on Piedras Creek. A man living near the aqueduct asserted to an investigator in 1897 that he had seen flood water overtop the aqueduct by as much as six feet without msterially damaging it.

The Espada Aqueduct operated regularly until the 1880s, at which time it fell idle. Then, in 1895, the owners of the water rights along the ditch organized a private company to utilize the irrigation potential of the old scequia. They cleaned, widened, and deepened the ditch, repaired the diversion dam, and made some changes in the course of the canal. At the conclusion of their work, the Espada Acequia had a grsde of 8 inches per mile, carried 10 cubic feet per second of water, and irrigated approximately 400 acres of land. At the end of the 19th century, farmers on the Espada system were sble to grow an average of one bale of cotton per acre, while farmers in the same vicinity who were without irrigation water grew only one-fourth as much. Truck farmers raised all kinds of vegetables "in the grestest profusion" on Espsda lands from early spring until first frost.

Today, the Espada Acequia is approximately four miles long, with an average bottom width of 5-1/2 feet. Its grade is now approximately 23 inches per mile, a slight increase over the 18 inchers per mile reported at the end of the last century. Tbis increase may be attributed to the shortening of the section above the aqueduct at least twice in this century. The present flow is approximately 12 cubic feet per second.

The section of the Ssn Antonio River across which the Espada Dam lies was bypsssed by a new flood control channel in the 1960s, but the San Antonio River Autbority took measures to oreserve the historic Espada Dam and to sustain the water level behind it and in the acequia.[38]

San Pedro Acequia

The San Pedro Acequis was the first of the acequias to be built by civilian colonists at San Antonio. Begun in 1738, the system provided water to the San Fernando Church, the Villa de San Fernando, and the military presidio of Bexar. The main canal was approximately 6 feet wide and 2 feet deep. It was 4 miles long and irrigated about 400 acres of civilian fields. The only acequia to tap San Pedro Creek, it flowed through the main plaza in a generally southerly direction that roughly corresponds to the course of present-day

North Flores Street. Passing in front of San Fernando Church on the weat side of the Plaza, the acequia continued on southward along the divide between the creek and the San Antonio River before returning to the river. Its location on the watershed left the ditch free from the crosa drainage that constantly troubled all of the other acequiaa. This location made the farmers along the San Pedro Acequia the only ones at San Antonio who could divert water both east and west for irrigation. By the mid-nineteenth century, the downtown aection of the San Pedro Acequia had been covered with removable panels that helped prevent people and animala from falling into the ditch.[39]

Upper Labor Acequia

The second acequia built by civilian settlers at San Antonio was the Upper Labor Acequia. Construction started in 1776 and it was operating two years later. It began behind a loose rock dam at the headsprings of the San Antonio River and flowed down the weat side of the river in a southerly direction roughly along what is now North St. Mary'a Street to the lower part of Tobin Hill. The canal then circled around the hill, croaaed present-day San Pedro Avenue, snd joined the San Pedro Acequia at West Laurel Street. During its active years, the Upper Labor Acequia watered 600 acrea of civilian-owned fielda, but by the end of the nineteenth century this acreage had dwindled to only 100 with much of the former landa conaumed by urban houaing. By the turn of the century, the acequia was completed abandoned.

Today, aeveral limited sections of the Upper Labor Acequia are visible. At its diveraion point at the northern end of Brackenridge Park, a reconstructed 50-yard section of the ditch carries water away from a channel draining part of the San Antonio Zoo. Here the acequia water ia diverted through a pipe into an old waterworks canal. The acequia channel, which now carries drainage water in the opposite direction from that in earlier days, continues through the zoo. Here, in a greatly modified state, the acequia serves aa the waterfowl area of the zoo. An additional trace of the old Upper Labor Acequia csn be seen in the open field opposite the Sunken Gardens in Brackenridge Park. The old loose rock diversion dam for the Upper Labor Acequia was replaced by city authoritiea in 1877 with a similar maaonry structure, but even this dam no longer exiata.[40]

Alazan Ditch

The Alazan Ditch, which might better be described as a branch of the Upper Labor Acequia, was one of the two ditch syatems built after the entrance of Americans to San Antonio. Deaigned by Mr. Francis Giraud to irrigate a number of small land holdings west of San Pedro Creek, construction of the acequia began in 1872 but was not finished until 1876. It took its water from the Upper Labor Acequia at a junction with it near San Pedro Springs, and proceeded westward roughly following present-day West Ashby Place to the Missouri Pacific Railroad tracks. Here, the Alazan Ditch turned south and paralleled the line of the railroad, across Fredericksburg Road to turn into present-day North Colorado Street at Menchaca. From this point, the acequia moved southeastward to the intersection of North Frio and Weat Commerce

Streets. It then flowed south along Frio to return to the river near South Laredo Street. The ditch was used for irrigation until 1896. All visible traces of the Alazan Ditch have been blotted out by urban growth.[41]

Valley Ditch

The other acequia constructed by Americans in San Antonio was the Valley Ditch. Built in 1872 according to plans prepared by a Mr. G. Friesleben, the Valley Ditch is thought to have been dug to supply water from the Alamo Madre Acequia to the then-unused Concepcion Acequia. (The Concepcion had been unused since the removal of its diversion dam from the San Antonio River in 1869.) The Valley Ditch drew its water from the Alamo Madre near Grand Avenue. It flowed from this point down Walnut Street to a course generally paralleling Goliad Roadd. The ditch then headed out beyond the southeastern limits of the city. Because of errors in its grade, the Valley Ditch was abandoned shortly after its completion in 1872. No traces of it are known to exist.[42]

FOOTNOTES

1 Seymour V. Connor, Texas, A History (New York: Thomas Y. Crowell, 1971), pp. 20-30; Marion A. Habig, The Alamo Chain of Missions (Chicago: Franciscan Herald Press, 1968), pp. 29-36.

2 Domingo de Teran, "The Expedition of Don Domingo de los Rios into Texas, (1691-1692)," translated by Mattie Austin Hatcher, Preliminary Studies of the Texas Catholic Historical Society, II, No. 1 (January 1932), pp. 3-4, 14.

3 Isidore Felex de Espinosa. "The Espinosa-Olivares-Aguirre Expedition of 1709: Espinosa's Diary," translated by Gabriel Tous, Preliminary Studies of the Texas Catholic Historical Society, I, No. 3 (March 1930), p. 5.

4 Fray Francisco Celiz, Diary of the Alarcon Expedition into Texas, 1718-1719, translated by Fritz Leo Hoffman, Quivira Society Publications, V (Los Angeles: Quivira Society, 1935), pp. 22-25, 40, 43-49.

5 Habig, The Alamo Chain of Missions, p. 38.

6 Celiz, p. 86. Nothing further is known of the canal for the civil settlement.

7 Habig, The Alamo Chain of Missions, pp. 42-44.

8 Ibid., p. 45

9 Ibid., p. 50.

10 Habig, pp. 45, 50-51, 55, 57-58; William Ferguson Hutson, Irrigation Systems in Texas, U. S. Geological Survey Water-Supply and Irrigation Paper No. 13 (Washington: Government Printing Office, 1898), pp. 43-44.

11 Herbert Eugene Bolton, Texas in the Middle Eighteenth Century, University of California Publications in Hidtory, Vol. III (Berkeley: University of California Press, 1915), pp. 20-98; Juan Augustin Morfi, History of Texas, 1673-1779 by Fray Juan Augustin Morfi, 2 Vols., translated and edited by Carlos Eduardo Castaneda, Quivira Society Publications, VI (Albuquerque: Quivira Society, 1935), Part I, p. 93; Habig, The Alamo Chain of Missions, pp. 56-71.

12 William Henry Holmes, "The Acequias of San Antonio," unpublished M. A. thesis, St. Mary's University, San Antonio, Texas, 1962, pp. 113-120; Mardith K. Schuetz, Excavations of a Section of the Acequia Madre in Bexar County, Texas, and Archaeological Investigations at Mission San Jose in April 1968, Texas Historical Survey Committee

Archa:ological Report No. 19 (Austin: Texas Historical Survey Commi:tee, 1970), p. 16.

13 Samuel [. Buck, Yanaguana's Successors (San Antonio: The Naylor Compa:y, 1949), p. 116; Habig, The Alamo Chain of Missions, pp. 83-89, 91-92; Marion A. Habig, San Antonio's Mission San Jose (San Antonio: The N:ylor Company, 1968), pp. 25-39; Holmes, p. 12.

14 Gaspar [ose de Solis, "The Solis Diary of 1767," translated by Peter P. Forre:tal, Preliminary Studies of the Texas Catholic Historical Society, I, No. 6 (March 1931), p. 20.

15 Morfi, Part I, p. 97.

16 Hutson, p. 45.

17 Edwin F. Arneson, "Early Irrigation in Texas," Southwestern Histc:rial Quarterly, XXV, No. 2 (October 1921), p. 129; Buck, pp. 120-124; Habig, The Alamo Chain of Missions, pp. 119-125.

18 Habig, The Alamo Chain of Missions, p. 147; Holmes, pp. 89, 101-105; Hutson, p. 45; San Antonio Express, February 11, 1869, p. 3.

19 Appendices to the Brief of the Plaintiffs in State of Texas et al. vs. Valm:nt Plantations (Mission, Tex.: Time Publishing Co., (1962), p. 8[illegible]; Arneson, p. 125; Habig, The Alamo Chain of Missions, pp. 156-158, 160-[illegible]68; Wells A. Hutchins, "The Community Acequia: Its Origin and Deve:opment," Southwestern Historical Quarterly, XXXI, No. 3 (Jan:ary 1928), p. 280.

20 Arneso:, pp. 125, 128-129; Habig, The Alamo Chain of Missions, pp. [illegible]92-204, 208-210; Holmes, pp. 25-26; Alto Sebastian Hoermann, The [illegible]aughter of Tehuan or Texas of the Past Century, translated by Aloi:s Braun (San Antonio: Standard Printing Company, 1932), p. 68.

21 Habig, The Alamo Chain of Missions, pp. 208, 210; Hutson, pp. 45-46; Jame:s G. Gibbs, Jr., Field Notes on Acequias of San Antonio, March 25-31, 1973, Historic Engineering Site Inventory, History of Engi:eering Program, Texss Tech University, Lubbock, Texas, p. 16.

22 Mattie Alice Austin, "The Municipal Government of San Fernando de Bexa:, 1730-1800," Southwestern Historical Quarterly, VIII, No. 4 (Apr:l 1905), pp. 293-310; I. J. Cox, "The Early Settlers of San Fernando," Southwestern Historical Quarterly, V, No. 2 (October 1901), pp. 142-140; I. J. Cox, "The Founding of the First Texas Municipality," Southwestern Historical Quarterly, II, No. 3 (January 1899), pp. 217-226.

23 Thomas F. Glick, The Old World Background of the Irrigation System of San Antonio, Texas, Southwestern Studies No. 35 (El Paso: Texas Western Press, 1972), pp. 37-38. Most historians give 1738-39 as the date for the construction of the San Pedro Acequia. Arneson, p. 124; Buck, p. 179; Hutson, p. 44; Louise Lomax, San Antonio's River (San Antonio: The Naylor Company, 1948), p. 27. At least as early as 1741 the acequia was well enough established to have a street named after it. Frederick C. Chabot, With the Makers of San Antonio (San Antonio: privately printed, 1937), p. 163.

24 Arneson, p. 124; Buck, pp. 176-182; William Corner, ed., San Antonio de Bexar (San Antonio: Bainbridge & Corner, 1890), p. 44; Hutson, pp. 44-45; 100th Anniversary Pioneer Flour Mills San Antonio, Texas 1851-1951 (San Antonio: The Naylor Company, (ca. 1951), p. 50; San Antonio Express, July 1, 1868, p. 3.

25 Buck, pp. 244-251; Corner, pp. 46-50; Thomas U. Taylor, Irrigation Systems of Texas, U. S. Geological Survey Water-Supply and Irrigation Paper No. 71 (Washington: Covernment Printing Office, 1902), p. 62.

26 Corner, pp. 49-50; Holmes, pp. 110-112; Hutson, p. 43; Charles P. Smith, City Engineer, Morrison & Fourmy's Revised Map of City of San Antonio, Texas (St. Louis: A. Cast & Co., 1883); Taylor, p. 52.

27 Corner, p. 45; Holmes, p. 106; San Antonio Daily Herald, May 6, 1874, p. 3.

28 Appendices to the Brief, p. 88; Sergio Carza, Cround-Water Resources of the San Antonio Area, Texas, Texas Water Development Board Report No. 34 (Austin: Texas Water Development Board, 1966), p. 1-28.

29 Glick, pp. 26-56; Joseph E. Minor and Malcolm L. Steinberg, A Brief on the Acequias of San Antonio (San Antonio: The San Antonio Branch of the Texas Section American Society of Civil Engineers, 1962), pp. iii, 2-4.

30 Arneson, p. 129.

31 Holmes, pp. 9-10.

32 Ibid., Arneson, pp. 128-129; Gibbs,, p. 1-17.

33 Arneson, p. 129; Holmes, p. 67; Hutson, p. 43.

34 Arneson, p. 124; Corner, pp. 44-45; Bolton, p. 98; Holmes, pp. 73-74, 118-19; Hutson, pp. 43-44; Minor, p. 14; Schuetz, pp. 3-16; Taylor, p. 52.

The Alamo Madre Acequia is the only acequia in San Antonio for which original stone lining has heen found. All of the other have simple earthen hanks. It is not know if other acequias were similarly stone lined.

35 Arneson, p. 125; Paul L. Czibesz, "Unknown Facts about Technical History in San Antonio," Typewritten (San Antonio: Southwest Research Institute, 1953), pp. 1-7; Holmes, p. 45; Minor, p. 10; Taylor, p. 53; U. S. Department of the Interior, National Park Service, Historic American Buildings Survey,, Site No. Tex-333, Mission San Jose y San Miguel de Aguayo, San Antonio, Bexar County, Texas, 1936.

36 Arneson, pp. 123-124; (Marion A. Habig), "Interpretive Program—Espada," Typewritten, n. d.; Holmes, pp. 24-25, 89, 101-105; Hutson, p. 45; Minor, p. 8, San Antonio Express, Febnruary 11, 1869, p. 3, Febnruary 16, 1869, p. 2; Taylor, p. 52.

37 Appendices to the Brief, p. 88; Arneson, p. 125; Holmes, p. 25; Hutson, p. 45; Minor, p. 10; Taylor, p. 53.

38 Arneson, pp. 125, 128-129; Gibbs, pp. 1-17; Habig, pp. 17-18; Holmes, pp. 25-26; Hutson, pp. 45-46; Minor, pp. 10-11; Taylor, pp. 53-54.

39 Arneson, p. 124; Corner, p. 44; Holmes, pp. 38-39; Hutson, pp. 44-45; Minor, p. 16; San Antonio Express, July 1, 1868, p. 3, Taylor, p. 52.

40 Arneson, pp. 124-125, 127; Corner, pp. 46-50; Holmes pp. 49, 56; Hutson, p. 43; Minor, p. 16; Taylor, p. 52.

41 Holmes, pp. 110-112; Hutson, p. 43; Minor, p. 18; Taylor, p. 52.

42 Holmes, p. 106.

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